MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The present Summary, for the year 1897, is based essentially upon data received from about 150 regular Weather Bureau stations and 30 regular Canadian stations, all reporting daily by telegraph. A revised chart of total annual precipitation will be published in the Annual Report of the Chief of the Weather Bureau when the data from all voluntary stations have been received. The tables for thunderstorms and auroras are, as usual, based on reports from both voluntary and regular observers. The statistical tables have generally been prepared by the Division of Records and Meteorological Data, A. J. Henry, Chief.

GENERAL CLIMATIC CONDITIONS.

ATMOSPHERIC PRESSURE.

The mean annual pressure for 1897 is shown numerically in Tables I and II, both for the respective stations and as reduced to sea level by the method explained in the MONTHLY WEATHER REVIEW for 1894, Vol. XXII, p. 538. The corresponding isobars for sea level are shown on Chart I. As the international conferences of meteorologists have uniformly urged the application of the reduction to standard gravity and the further reduction to sea level by the tables and methods of the International Meteorological Committee, the Editor has requested Mr. Park Morrill, forecast official, to make the corresponding corrections and reductions, not only for sea level, but also for an upper level of 10,000 feet above the sea; these are given on Charts IV and V. The tables for passing from sea level upward to 10,000 feet are given on page 494 of the MONTHLY WEATHER REVIEW for 1895 or page 491 of the REVIEW for 1896. A general average decrement of temperature is assumed at the rate of 2° F. per 1,000 feet, or 0.37° C. per 100 meters, or about one-third of the adiabatic rate. Corresponding isobars for the level of 5,000 meters, or 16,404 feet, may be drawn by means of the table computed by Koeppen and published on page 419 of the MONTHLY WEATHER REVIEW for November, 1896.

The data on Chart I show that the highest pressures at sea level, not corrected for gravity, were 30.13 inches at Charleston, 30.12 at Knoxville, 30.11 at Chattanooga and Atlanta, respectively. The highest pressure for 1896 was 30.14 at Charleston. The lowest pressure for 1897 was 29.88, at Phœnix, as against 29.89, at the same station, in 1896.

The data on Chart IV show that the true pressure gradients at sea level differ appreciably from the apparent gradients shown on Chart I. The data on Chart V show that the high-level gradients are steeper, and that, therefore, the currents of air must be swifter than at sea level. As the atmosphere is a mixture of ascending and descending currents, which necessarily interact on each other, therefore, both the upper and lower gradients and winds and temperatures represent the result of the vertical interchange of air that is perpetually going on. The resultant surface winds, as also the upper currents, indicated by the clouds, are each related to both the upper and lower isobars.

AREAS OF HIGH AND LOW PRESSURE.

The average daily and hourly movements of the centers of these areas are given both by paths and by days in the individual tables of the successive MONTHLY WEATHER REVIEWS, and the monthly sums are collected together in the following table (A), which also gives the annual means by paths and by days.

These averages show the same peculiarities as those for previous years, namely, that the means taken by days are in all cases smaller than those taken by paths by about one-half of 1 per cent. This is apparently due to the fact that the numerous paths of rapid movements and short durations outweigh those of slow movement and long duration. If the movements of the centers depend upon the general movement of the upper portion of the atmosphere, as may be the case, then the general average movement of the atmosphere over the United States during 1897 was about the same as in 1896, as shown by the corresponding numbers, 550 and 549, or 606 and 612, respectively.

TABLE A.—*Movements of areas of high and low pressure for* 1897.

Month.	High areas.				Low areas.			
	By paths.		By days.		By paths.		By days.	
	No.	Movement.	No.	Movement.	No.	Movement.	No.	Movement.
		Miles.		*Miles.*		*Miles.*		*Miles.*
January	6	3,930	17.0	11,170	9	6,291	35.5	24,180
February	8	5,019	29.5	17,120	11	8,267	43.0	31,240
March	6	3,699	26.5	15,510	12	7,973	39.5	24,430
April	11	6,343	47.5	27,210	8	4,484	42.5	23,240
May	7	3,256	51.5	23,960	11	5,431	45.0	22,290
June	7	3,980	36.5	19,790	9	5,266	31.0	17,410
July	4	1,997	22.0	10,870	8	3,742	40.5	19,290
August	8	4,828	35.0	19,144	9	4,764	44.5	22,004
September	9	4,689	41.0	21,990	10	6,181	42.5	26,100
October	10	5,916	47.0	26,410	12	7,680	38.0	22,530
November	7	4,335	43.0	25,120	8	5,324	38.5	25,940
December	7	3,855	35.0	18,820	12	9,327	44.0	33,860
Sums	90	51,847	431.5	237,114	119	74,689	484.5	293,514
Mean daily velocity	576		550		628		606	
Mean hourly velocity	24.0		22.9		26.2		25.2	

As the corresponding table for 1896, on page 488 of the Summary and volume for that year, contained a clerical error the following is to be substituted for it:

Movement of areas of high and low pressures for 1896.

Month.	High areas.				Low areas.			
	By paths.		By days.		By paths.		By days.	
	No.	Movement.	No.	Movement.	No.	Movement.	No.	Movement.
		Miles.		Miles.		Miles.		Miles.
January	10	5,317	45.5	21,880	9	5,435	38.0	21,330
February	7	4,447	34.5	20,290	14	9,931	50.0	23,950
March	8	4,512	39.0	22,460	10	6,698	42.0	26,760
April	6	3,036	26.0	13,430	9	5,086	36.5	20,330
May	7	3,941	33.0	18,530	10	5,075	41.5	19,960
June	7	3,965	44.5	24,470	8	4,620	35.0	20,350
July	7	3,734	22.0	11,990	11	6,302	38.5	22,550
August	6	3,234	29.0	20,950	10	6,617	34.0	22,360
September	7	4,148	30.0	22,900	11	6,631	39.0	24,330
October	10	5,344	44.0	23,530	9	4,832	35.0	18,060
November	5	3,307	22.5	13,810	8	6,491	33.5	25,250
December	8	4,754	32.5	18,390	12	9,171	43.0	21,330
Sums	88	49,639	421.5	251,260	121	76,891	466.0	285,250
Mean daily velocity	564		549		685		612	
Mean hourly velocity	23.5		22.9		28.5		25.5	

TEMPERATURE.

The mean annual temperature at the surface of the ground is approximately shown by the isotherms on Chart I or by the individual figures given in Table I.

The lowest annual averages within the United States were: Williston, 38.8; Moorhead, 39.2; Bismarck and Duluth, 39.5 each.

The highest averages were: Key West, 77.2; Jupiter, 74.1; Tampa, 72.2; Corpus Christi, 70.7; Galveston, 70.2.

The mean annual temperature was above the normal at 101 stations, below at 20, and normal at 12.

The extreme temperatures of the year, or the absolute maxima and minima, are given in Table I and are shown by the isotherms on Chart II. The absolute range of temperature during the year is easily obtained by comparing the full and dotted lines on the same chart.

Maximum temperatures equaling or exceeding 105 occurred at Shreveport, Topeka, Abilene, Phœnix, Yuma, Walla Walla, Redbluff, Sacramento, and Fresno.

Minimum temperatures of —25 or lower occurred at Duluth, Moorhead, Bismarck, Williston, Minneapolis, St. Paul, Huron, and Havre.

The only portions of the country not visited by frost, assuming that frost does not occur with air temperatures above 32°, were the southern end of the peninsula of Florida and the coast line of southern California.

The large annual ranges of temperature were, as usual, in North Dakota and the Northern Slope, viz: Havre, 140°; Bismarck, 138°; Williston, 136; and Moorhead, 129°. The smallest annual ranges were: Key West, 40°; Eureka, 52°; and San Diego, 53°.

The accumulated departures of average monthly temperatures from the normal values are given in Table III. There has been a steadily accumulating deficiency in temperature throughout the Pacific Coast, middle, and southern Plateau regions, amounting to 8° at the end of the year; the northern Slope and North Dakota temperatures also diminished. In other regions there was a steady increase of positive departures, the maximum being in the Gulf and Lake regions.

MOISTURE.

The mean temperature of the dew-point and the mean relative humidity are given in Table I.

The mean temperature of the wet-bulb thermometer has been given for each month, and the average for the year can be easily inferred from Table I, as it is approximately midway between the temperature of the dew-point and the temperature of the air.

The total quantity of moisture in the atmosphere for the current year can be found by the table on pages 539–540 of the Annual Summary for 1894, and does not differ to any important extent from the figures there given for that year.

Evidently, the total rainfall during any year depends upon some other factor than the mere presence of moisture in the air; there is almost always enough moisture present but other conditions may be unfavorable.

PRECIPITATION.

The total fall of rain and melted snow for the calendar year, at regular Weather Bureau and Canadian stations, is presented on Chart III.

In 1894 precipitation was below average in every district east of the Rocky Mountains; in 1895 there was an excess of precipitation in the southern and middle Slopes, but elsewhere between the Rocky Mountains and the Atlantic seaboard there was a marked deficiency. In 1896 there was an excess of rainfall in the extreme Northwest, the upper Mississippi Valley, the Missouri Valley, and the northern and southern Slopes. The year 1897 opened with heavy rains in the lower Mississippi Valley, Tennessee, Alabama, and adjoining regions, and it seemed as if the period of diminished rainfall had come to a close. The rainfall of May was about average, except in the Gulf States, Arkansas, Missouri, and upper Mississippi valleys. The June rainfall was generally below the average, but in July unusually heavy rains fell throughout New England, the upper Lake Region, upper Mississippi Valley, Florida, and portions of the Ohio Valley and the Middle and South Atlantic States. By the middle of August a drought had set in over practically all of the territory east of the Rocky Mountains, which was not broken in some localities until about the 1st of November, and the year ended as one of generally deficient rainfall.

The stations having the largest deficiencies during 1897 are: Galveston, Tex., 19.44 inches; New Orleans, La., 17.05 inches; Raleigh, N. C., 16.94 inches; Wilmington, N. C., 16.66 inches. The stations having the largest excesses are: Jupiter, Fla., 29.09 inches; Fort Canby, Wash., 12.88 inches; New Haven, Conn., 9.98 inches.

The fall of snow for the so-called snow year, namely, from July 1 to June 30, inclusive, is given in the Annual Report of the Chief of the Weather Bureau.

The accumulated departures of the total monthly precipitation from the normal values are shown in Table IV, from which it appears that the total annual precipitation was normal in one district, above the normal in 6, and below in the remaining 14. As in previous years, the greatest deficiency exists in the west Gulf States and lower Mississippi Valley. Precipitation has been below normal in this region since 1890. The deficit during 1897 has been steadily increasing in the Middle and South Atlantic regions, east and west Gulf, upper and lower Lake, Missouri, and upper Mississippi valleys, but a notable excess has accumulated in the Florida Peninsula.

WIND.

The prevailing direction of the wind, namely, that which occurred most frequently at 8 a. m. and 8 p. m., seventy-fifth meridian time, is given in Table I. The annual resultant wind deduced from all the 8 a. m. and 8 p. m. observations of direction, without taking into account the velocity of the wind, is given in Table V; this computation is equivalent to